Space Weather Technical Forecast

Issued on Monday, 28 February 2022 at 13:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of R1/Minor radio blackouts. Slight chance of G1/Minor Storm, increasing Day 4 (03 Mar).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low in the last 24 hours with a C3.1 flare observed at 28/0918 UTC, from a plage region near the southeast limb. This caused a CME, but it is thought unlikely that this will have an Earth-directed component, however further analysis will be required as imagery becomes available. No other Earth-directed CMEs were observed in the available imagery during the past 24 hours.

Over the past 24 hours there has been 4-6 sunspot regions coming and going on the visible disc. AR2954 and AR2955 remain stable and mature Hsx / Alpha regions, and have shown little activity. All other regions have generally been small and simple Alpha or Beta regions which have decayed at times. However, a new region in the northeast (AR2958) has shown signs of growth over the past 12 hours and is now classified Bxi/Beta-Gamma.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, showed characteristics of a positive polarity high speed stream, most likely CH58. Wind speeds have been slightly elevated or elevated, varying between 450 and 530 km/s. The density has been average or slightly above average, between 7 and 13 ppcc. The IMF Bt was generally weak (<8 nT) but rose to moderate (8-10 nT) between 27/2030 UTC and 28/0450 UTC. The north-south component, Bz, was weak and generally positive, varying between -7 and +8 nT. The Phi angle was predominantly positive (away from the Sun). Resultant geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2 MeV) has generally been at background levels. The corresponding 24-hour integrated electron fluence was below the Active (1e8 integrated pfu) threshold with a declining trend. The 28/0000 UTC observation was 5.33e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Low or Very Low, with a chance of further C-class flares. There is just a slight chance of M-class flares. This may increase slightly in the coming days, with a couple of potential regions rotating on in 2-3 days time.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast. A series of coronal hole high speed stream (HSS) connections are expected during this period, with winds likely to exceed 500 km/s at times. Geomagnetic activity is expected to be Quiet to Unsettled, with occasional Active intervals, and a very slight chance of G1/Minor Storm intervals. This declining to mainly Quiet during day 3 (2nd). Earth may connect to a further coronal hole high speed stream later on day 4 (3rd), this is more likely to give G1/Minor Storm periods due to the time of year and negative polarity, although the timing is uncertain.

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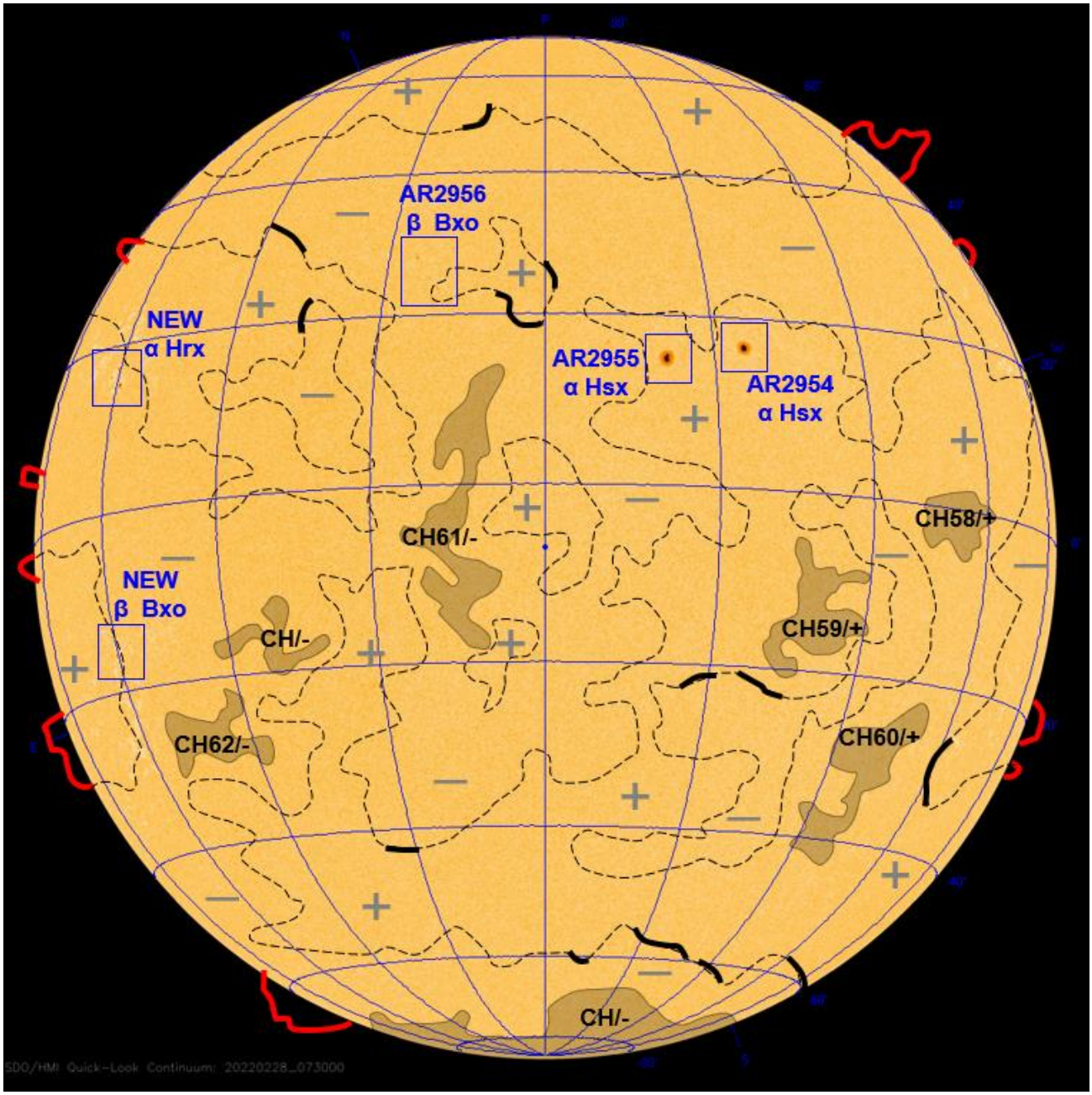
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. High energy electron flux is likely to follow an erratic rising trend, with the possibility of exceeding the high (1e3 pfu) threshold during diurnal peaks. Electron fluence is also forecast to follow an erratic rising trend, and may approach the Active (1e8 integrated pfu) threshold later in the forecast period, although currently expected to remain just below. Confidence is low however.

Figure 1. Solar Analysis Valid 28/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are currently no Earth-directed CMEs forecast.
Solar wind speeds are currently at elevated levels following a connection with the high speed stream from either coronal hole 58 or 60. A further connection with coronal hole 59 is then probable late on days 1 into day 2 (28 Feb - 01 Mar), with elevated wind speeds likely lasting into day 3 (02 Mar) before slowly easing. It is probable that the effects will merge, making it difficult to tell the individual features apart when they arrive at L1. These features appeared weaker in imagery on the previous rotation, and wind speeds from the previous rotation were also contaminated by CME arrivals.
There is a further coronal hole 61, which is negative polarity, and Earth may connect to the high speed from this during the later part of day 4 (03 Mar). The timing of this persistent feature is a little uncertain however, due to CME contamination on the previous rotation, and it may arrive after the end of this period.

The coronal holes through Days 1 and 2 are all positive polarity, which are less favoured for a significant geomagnetic response at this time of year. As such, geomagnetic activity is expected to be Quiet to Unsettled, with occasional Active intervals, and a very slight chance of G1/Minor Storm intervals. This declining to mainly Quiet conditions during day 3. If coronal hole 61 does arrive later on day 4, this is more likely to give G1/Minor Storm periods due to the time of year and negative polarity.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	5	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

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Radio Blackouts - X-Ray Flares:

Solar activity is currently at Low levels, with one C-class flare in the last 24 hours. There are currently five sunspot regions on the visible disc. AR2954 and AR2955, in the northwest quadrant are both mature and stable, classified as Hsx/Alpha, and have shown little activity. All other regions are small and simple unipolar or bipolar regions in the eastern hemisphere. There are a couple of potential regions showing as bright spots on STEREO-A EUVI imagery, that are likely to rotate on to the Earth facing disc in 2-3 days time.
Solar activity is expected to remain Low or Very Low but there is a slight chance of increasing to Moderate levels with isolated M-class flares. Most likely later in the period as new regions possibly rotate round the east limb.

X Ray Flares / Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	5	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES 16 is at background levels, and expected to remain at this level with no solar radiation storms occurring.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) has dropped out to background levels following the recent CIR. However, with Earth expected to be affected by various high speed streams in the coming days further charging is likely to occur. Any CIR associated with these arrivals may cause temporary suppression, however an erratic increasing trend is most probable over the coming days, but with some variation in the peak values day to day.
Associated electron fluence is likely to rise due to charging from the various high speed streams, but the level it will reach is subject to some uncertainty. Confidence is low, due to the uncertainty surrounding the charging / suppression cycle of several high speed streams in the coming days.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^{8}$	No	5	20	30	40
Very Active	≥ 2 MeV ≥ $1x10^{9}$	No	1	1	1	1

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